Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A sustained release pharmaceutical formulation for delivery to the lungs of a patient by inhalation comprising:

porous microparticles which comprise a pharmaceutical agent and a hydrophobic matrix material, the microparticles having a geometric size between 0.1 μm and 5 μm and an average porosity between 15 % and 90 % by volume,

wherein the combination of the pharmaceutical agent, matrix material, geometric size, and average porosity are selected to provide that, upon inhalation of the formulation into the lungs, a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 2 hours.

2. (Original) The formulation of claim 1, wherein a majority of the pharmaceutical agent is released from the microparticles by 24 hours following inhalation.

3. (Currently Amended) A sustained release pharmaceutical formulation for delivery to the lungs of a patient by inhalation comprising:

porous microparticles which comprise a pharmaceutical agent and a hydrophobic matrix material, the microparticles having a geometric size between 0.1 μm and 5 μm and an average porosity between 15 % and 90 % by volume,

wherein the combination of the pharmaceutical agent, matrix material, geometric size, and average porosity are selected to provide that, upon inhalation of the formulation into the lungs, a majority of the pharmaceutical agent is released no earlier than about 2 hours and no later than about 24 hours following inhalation.

4. (Previously Presented) The formulation of claim 1, wherein the porous microparticles have a geometric size between 1.7 μm and 3.8 μm.

5. (Previously Presented) The formulation of claim 1, wherein the matrix material is present in the formulation in an amount between about 50 wt. % and about 90 wt. %.

6. (Previously Presented) The formulation of claim 1, wherein the porous microparticles have an average porosity between about 28 % and about 81 % by volume.

7. (Original) The formulation of claim 1, wherein the pharmaceutical agent is a bronchodilator, a steroid, an antibiotic, an antiasthmatic, an antineoplastic, a peptide, or a protein.

8. (Original) The formulation of claim 1, wherein the pharmaceutical agent comprises a corticosteroid.

9. (Original) The formulation of claim 6, wherein the corticosteroid is selected from the group consisting of budesonide, fluticasone propionate, beclomethasone dipropionate, mometasone, flunisolide, and triamcinolone acetonide.

10. (Original) The formulation of claim 1, wherein the matrix material comprises a biocompatible synthetic polymer, a lipid, a hydrophobic molecule, or a combination thereof.

11. (Currently Amended) The formulation of claim 10, wherein the synthetic polymer comprises a polymer selected from the group consisting of poly(hydroxy acids), poly(lactide), poly(glycolide), poly(lactide-co-glycolide), polyanhydrides, polyorthoesters, polyamides, polyalkylenes, ~~polyalkylene glycols, polyalkylene oxides, polyvinyl alcohols,~~ polyvinyl ethers, ~~polyvinylpyrrolidone,~~ poly(butyric acid), poly(valeric acid), and poly(lactide-co-caprolactone), copolymers, derivatives, and blends thereof.

12. (Original) The formulation of claim 10, wherein the synthetic polymer comprises a poly(lactic acid), a poly(glycolic acid), a poly(lactic-co-glycolic acid), or a poly(lactide-co-glycolide).

13. (Cancelled).

14. (Original) The formulation of claim 1, wherein a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 4 hours.

15. (Original) The formulation of claim 1, wherein a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 6 hours.

16. (Original) The formulation of claim 1, wherein a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 8 hours.

17. (Original) The formulation of claim 1, wherein a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 16 hours.

18. (Original) The formulation of claim 1, wherein a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 20 hours.

19. (Original) The formulation of claim 3, wherein a majority of the pharmaceutical agent is released no earlier than about 6 hours and no later than about 18 hours following inhalation.

20. (Original) The formulation of claim 3, wherein a majority of the pharmaceutical agent is released no earlier than about 4 hours and no later than about 12 hours following inhalation.

21. (Original) The formulation of claim 1, wherein at least 50% by weight of the microparticles delivered to the lung is delivered to the combined central and upper lung upon inhalation by the patient.

22. (Original) The formulation of claim 1, further comprising one or more pharmaceutically acceptable bulking agents blended with the porous microparticles to form a dry powder blend formulation.

23. (Original) The formulation of claim 22, wherein the bulking agent comprises particles which have a volume average size between 10 and 500 μm.

24. (Original) The formulation of claim 22, wherein the bulking agent is selected from the group consisting of lactose, mannitol, sorbitol, trehalose, xylitol, and combinations thereof.

25. (Original) The formulation of claim 1, wherein the porous microparticles further comprise one or more surfactants.

26. (Original) The formulation of claim 25, wherein the one or more surfactants comprises a phospholipid.

27. (Original) The formulation of claim 1, further comprising one or more pharmaceutically acceptable suspending agents that are liquid within a metered dose inhaler to form a metered dose inhaler formulation.

28. (Original) The formulation of claim 1, further comprising one or more other pharmaceutical agents.

29. (Original) The formulation of claim 1, further comprising additional microparticles blended with the porous microparticles.

30. (Original) The formulation of claim 29, wherein the additional microparticles comprise one or more other pharmaceutical agents.

31. (Currently Amended) A dry powder sustained release pharmaceutical formulation for delivery to the lungs of a patient by inhalation comprising:

porous microparticles having a geometric size between 0.1 μm and 5 μm and an average porosity between 15 % and 90 % by volume, the porous microparticles being formed of at least a pharmaceutical agent, a hydrophobic matrix material, and a surfactant; and

a pharmaceutically acceptable bulking agent blended with the porous microparticles,

wherein the combination of the pharmaceutical agent, matrix material, geometric size, and average porosity are selected to provide that, upon inhalation of the formulation into the lungs, a majority of the pharmaceutical agent is released no earlier than about 2 hours and no later than about 24 hours following inhalation.

32. (Currently Amended) A sustained release pharmaceutical formulation for delivery to the lungs of a patient by inhalation comprising:

porous microparticles which comprise a pharmaceutical agent and a hydrophobic matrix material, the microparticles having a geometric size between 0.1 μm and 5 μm and an average porosity between 15 % and 90 % by volume,

wherein the combination of the pharmaceutical agent, matrix material, geometric size, and average porosity are selected to provide that, upon inhalation of the formulation into the lungs, there is an increase in MAT_{inh} of at least 25% compared to the MAT_{inh} obtained when the pharmaceutical agent is administered by inhalation of microparticles not in the form of porous microparticles which comprise the pharmaceutical agent and the matrix material.

33. (Currently Amended) A method of delivering a pharmaceutical agent to the lungs of a patient comprising:

having the patient inhale a sustained release pharmaceutical formulation which comprises porous microparticles which comprise a pharmaceutical agent and a hydrophobic matrix material, the microparticles having a geometric size between 0.1 μm and 5 μm and an average porosity between 15 % and 90 % by volume, wherein the combination of the pharmaceutical agent, matrix material, geometric size, and average porosity are selected to provide that, upon inhalation of the formulation into the lungs, a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 2 hours.

34. (Original) The method of claim 33, wherein a majority of the pharmaceutical agent is released from the microparticles by 24 hours following inhalation.

35. (Original) The method of claim 33, wherein the patient is in need of treatment for a respiratory disease or disorder.

36. (Original) The method of claim 33, wherein the patient suffers from asthma, and the pharmaceutical agent is one effective in the treatment or control of asthma.

37. (Original) The method of claim 33, wherein the pharmaceutical agent is a corticosteroid.

38. (Original) The method of claim 33, wherein a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 4 hours.

39. (Original) The method of claim 33, wherein a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 8 hours.

40. (Original) The method of claim 33, wherein a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 16 hours.

41. (Original) The method of claim 35, wherein a majority of the pharmaceutical agent is released no earlier than about 10 hours and no later than about 24 hours following inhalation.

42. (Original) The method of claim 35, wherein a majority of the pharmaceutical agent is released no earlier than about 6 hours and no later than about 18 hours following inhalation.

43. (Original) The method of claim 33, wherein upon inhalation of the formulation into the lungs there is an increase in MAT_{inh} of at least 25% compared to the MAT_{inh} obtained when the pharmaceutical agent is administered by inhalation of microparticles not in the form of porous microparticles which comprise the pharmaceutical agent and the matrix material.

44. (Original) The method of claim 33, wherein the patient orally inhales the sustained release formulation using a dry powder inhalation device.

45. (Original) The method of claim 33, wherein the formulation provides local or plasma concentrations which do not fluctuate by more than a factor of four over the period of sustained release.

46. (Currently Amended) A method for making a dry powder formulation for inhalation and sustained release of pharmaceutical agent comprising:

dissolving a hydrophobic matrix material in a volatile solvent to form a solution;

adding a pharmaceutical agent to the solution to form an emulsion, suspension, or second solution; and

removing the volatile solvent from the emulsion, suspension, or second solution to yield porous microparticles which comprise the pharmaceutical agent and the matrix material, the microparticles having a geometric size between 0.1 μm and 5 μm and an average porosity between 15 % and 90 % by volume,

wherein the combination of the pharmaceutical agent, matrix material, geometric size, and average porosity are selected to provide that, upon inhalation of the formulation into the lungs, a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 2 hours.

47. (Original) The method of claim 46, wherein the matrix material comprises a biocompatible synthetic polymer, and the volatile solvent comprises an organic solvent.

48. (Original) The method of claim 46, further comprising combining one or more surfactants with the solution.

49. (Original) The method of claim 46, wherein the surfactant comprises a phospholipid.

50. (Currently Amended) A method for making a dry powder formulation for inhalation and sustained release of pharmaceutical agent comprising:

dissolving a hydrophobic matrix material in a volatile solvent to form a solution;

adding a pharmaceutical agent to the solution;

combining at least one pore forming agent with the pharmaceutical agent in the solution to form an emulsion, suspension, or second solution; and

removing the volatile solvent and the pore forming agent from the emulsion, suspension, or second solution to yield porous microparticles which comprise the pharmaceutical agent and the matrix material, the microparticles having a geometric size between 0.1 μm and 5 μm and an average porosity between 15 % and 90 % by volume,

wherein the combination of the pharmaceutical agent, matrix material, geometric size, and average porosity are selected to provide that, upon inhalation of the formulation into the lungs, a therapeutically or prophylactically effective amount of the pharmaceutical agent is released from the microparticles in the lungs for at least 2 hours.

51. (Original) The method of claim 50, wherein the pore forming agent is in the form of an aqueous solution when combined with the solution comprising matrix material.

52. (Original) The method of claim 50, wherein the pore forming agent is a volatile salt.

53. (Original) The method of claim 50, the step of removing the volatile solvent and pore forming agent from the emulsion, suspension, or second solution is conducted using a process selected from spray drying, evaporation, fluid bed drying, lyophilization, vacuum drying, or a combination thereof.

54. (Original) The method of claim 50, further comprising blending the porous microparticles with a pharmaceutically acceptable bulking agent.

55. (Original) The method of claim 54, wherein the bulking agent is selected from the group consisting of lactose, mannitol, sorbitol, trehalose, xylitol, and combinations thereof.

56. (Original) The method of claim 54, wherein the pharmaceutical agent comprises a corticosteroid.